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EXAMINER	
KENNEDY, JENNIFER M	

ART UNIT	PAPER NUMBER
2812	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/053,572	OHNUMA, HIDETO	
	Examiner	Art Unit	
	Jennifer M. Kennedy	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/16/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 16, 2005 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al. (U.S. Patent Appl 2002/0098635) in view of Ohtani et al. (U.S. Patent No. 5,966,596).

In re claim 1, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), forming an oxide film (33) on a surface of the semiconductor film comprising silicon, doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118]-[0119]) and

forming at least one channel region comprising a portion of the doped semiconductor film (see [0121]-[0124]).

Zhang et al. does not disclose the method of forming a chemical oxide film. The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film using a liquid chemical (see column 2, lines 44-46, and column 6, lines 55-64). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 4, Zhang et al. teaches the method wherein the semiconductor film comprising silicon is an amorphous semiconductor film comprising silicon (31, see [0117]).

In re claims 7, 10, and 22, Zhang et al does not disclose the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film. Ohtani et al. also discloses the method wherein a catalytic element

of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film (see column 7, lines 20-50). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a catalytic element of Ni to the amorphous silicon film of Zhang et al. in order to accelerate the crystallization of the amorphous silicon film, thereby increasing throughput.

In re claim 13, Zhang et al. teaches the method wherein the material including hydrogen is used as the ion source for the impurity ions (see [0118]-[0119]).

In re claim 16, Zhang et al. teaches the method wherein the doping step allows channel doping to be implemented (see [0124]). The examiner notes that the doping step of ([0118]-[0119]) creates a doped silicon layer 34, which is subsequently doped and renumbered 35 and 36 (see Figure 8A-8D). The doped silicon layer is then etched into island-like semiconductor layers 11 and 12 (see [0121]), of which a portion of each are the channel region.

In re claims 19, 20, and 21, Ohtani et al. discloses the chemical oxide film is formed by treatment with ozone water, hydrogen peroxide or by ozone treatment through ultraviolet irradiation in an atmosphere containing oxygen (see column 2, lines 44-46).

In re claim 24, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses

that the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 37, the combined Zhang et al. and Ohtani et al. disclose the method wherein the chemical oxide film is 5 nm or less (see Ohtani et al. column 2, lines 39-41).

In re claim 2, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), forming an oxide (33) film which protects the semiconductor film from being etched by a subsequent doping step (33) on a surface of the semiconductor film comprising silicon, doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118]-[0119]) and forming at least one channel region comprising a portion of the doped semiconductor film (see [0121]-[0124]).

The examiner notes that the protective oxide layer, 33, of Zhang et al. is formed directly prior to the doping process of Zhang et al. and therefore is formed to protect during the doping process. Further, Zhang et al. teaches that the acceleration voltage of the dopant is adjusted in accordance with the thickness of the protective oxide (see [0118]). The protective oxide layer of Zhang et al. will to some degree prevent etching of the surface of the semiconductor film when compared with a semiconductor film without the protective oxide formed thereon.

Zhang et al. does not disclose the method of terminating the dangling bonds on a surface of the semiconductor film with oxygen. Ohtani et al. discloses a method of forming a chemical oxide film by ultraviolet radiation within an oxygen ambient or immersing the substrate in ozone water or hydrogen peroxide water (see column 2, lines 39-46 and column 6, lines 55-64).

Ohtani et al. does not explicitly state that the pretreatment terminates dangling bonds on a surface of the semiconductor film with oxygen. However, as explained in the applicant's specification the termination of bonds in the present application occur with oxygen (see specification, page 17, line 13 through page 18, line 5). The examiner points out that the amorphous silicon of Ohtani et al. is oxidized by illuminating the substrate with a UV light in an oxygen ambient to form the chemical oxide. The examiner notes that UV light increases the reactivity of the oxygen atoms, and it is clear by the formation of the oxide that the oxygen molecules react on the surface of the substrate, thus terminating the dangling bonds on the surface of the semiconductor film with oxygen. Finally the examiner notes that Ohtani et al. discloses the same conditions and steps as that of the applicant's disclosure with respect to forming the oxide. Applicant has not provided any required conditions for forming the oxide that would terminate the dangling bonds other than the presence of oxygen.

The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be

used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64) that terminates dangling bonds with oxygen as explained above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 5, Zhang et al. teaches the method wherein the semiconductor film comprising silicon is an amorphous semiconductor film comprising silicon (31, see [0117]).

In re claims 8 and 11, Zhang et al does not disclose the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film. Ohtani et al. also discloses the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film (see column 7, lines 20-50). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a catalytic element of Ni to the amorphous silicon film of Zhang et al. in order to accelerate the crystallization of the amorphous silicon film, thereby increasing throughput.

In re claim 14, Zhang et al. teaches the method wherein the material including hydrogen is used as the ion source for the impurity ions (see [0118]-[0119]).

In re claim 17, Zhang et al. teaches the method wherein the doping step allows channel doping to be implemented (see [0124]). The examiner notes that the doping step of ([0118-0119]) creates a doped silicon layer 34, which is subsequently doped and renumbered 35 and 36 (see Figure 8A-8D). The doped silicon layer is then etched into island-like semiconductor layers 11 and 12 (see [0121]), of which a portion of each are the channel region.

In re claim 25, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 3, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), forming an oxide film (33) which protects the semiconductor film from being etched by a subsequent doping step (33) on a surface of the semiconductor film comprising silicon, doping the semiconductor film

comprising silicon with impurity ions through the oxide film (see [0118]-[0119]) and forming at least one channel region comprising a portion of the doped semiconductor film (see [0121]-[0124]).

The examiner notes that the protective oxide layer, 33, of Zhang et al. is formed directly prior to the doping process of Zhang et al. and therefore is formed to protect during the doping process. Further, Zhang et al. teaches that the acceleration voltage of the dopant is adjusted in accordance with the thickness of the protective oxide (see [0118]). The protective oxide layer of Zhang et al. will to some degree prevent etching of the surface of the semiconductor film when compared with a semiconductor film without the protective oxide formed thereon.

Zhang et al. does not disclose the method of terminating the dangling bonds on a surface of the semiconductor film with an element to be bonded with bonding energy higher than that of Si-H bonds. Ohtani et al. discloses a method of forming a chemical oxide film by ultraviolet radiation within an oxygen ambient or immersing the substrate in ozone water or hydrogen peroxide water (see column 2, lines 39-46 and column 6, lines 55-64).

Ohtani et al. does not explicitly state that the pretreatment terminates dangling bonds on a surface of the semiconductor film with an element to be bonded with bonding energy higher than that of Si-H bonds. However, as explained in the applicant's specification the termination of bonds in the present application occur with oxygen which is an with an element to be bonded with bonding energy higher than that of Si-H bonds (see specification, page 17, line 13 through page 18, line 5). The

examiner points out that the amorphous silicon of Ohtani et al. is oxidized by illuminating the substrate with a UV light in an oxygen ambient to form the chemical oxide. The examiner notes that UV light increases the reactivity of the oxygen atoms, and it is clear by the formation of the oxide that the oxygen molecules react on the surface of the substrate, thus terminating the dangling bonds on the surface of the semiconductor film with oxygen. Finally the examiner notes that Ohtani et al. discloses the same conditions and steps as that of the applicant's disclosure with respect to forming the oxide. Applicant has not provided any required conditions for forming the oxide that would terminate the dangling bonds other than the presence of oxygen.

The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer ,33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64) that terminates dangling bonds on a surface of the semiconductor film with an element to be bonded with bonding energy higher than that of Si-H bonds as explained above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known

method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 6, Zhang et al. teaches the method wherein the semiconductor film comprising silicon is an amorphous semiconductor film comprising silicon (31, see [0117]).

In re claims 9 and 12, Zhang et al does not disclose the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film. Ohtani et al. also discloses the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film (see column 7, lines 20-50). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a catalytic element of Ni to the amorphous silicon film of Zhang et al. in order to accelerate the crystallization of the amorphous silicon film, thereby increasing throughput.

In re claim 15, Zhang et al. teaches the method wherein the material including hydrogen is used as the ion source for the impurity ions (see [0118]-[0119]).

In re claim 18, Zhang et al. teaches the method wherein the doping step allows channel doping to be implemented (see [0124]). The examiner notes that the doping step of [0118-0119]) creates a doped silicon layer 34, which is subsequently doped and renumbered 35 and 36 (see Figure 8A-8D). The doped silicon layer is then etched into

island-like semiconductor layers 11 and 12 (see [0121]), of which a portion of each are the channel region.

In re claim 26, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 23, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31), specifically amorphous silicon, over an insulating substrate (1), forming a oxide film (33) on a surface of the semiconductor film comprising silicon, and doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118]-[0119]), patterning the semiconductor film to form at least on active layer after doping (see [0121]), forming a gate insulating film (5) over the active layer after patterning the semiconductor film and forming a gate electrode (6) over the semiconductor film with the gate insulating film interposed therebetween.

Zhang et al. does not disclose the method of forming a chemical oxide film, wherein the chemical oxide film is formed by a treatment with at least one material

selected form the group of ozone water and a hydrogen peroxide solution. The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film wherein the chemical oxide film is formed by a treatment with at least one material selected from the group of ozone water and a hydrogen peroxide solution, which are liquid chemicals (see column 2, lines 44-46, and column 6, lines 55-64). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani et al. is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 27, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was

made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 38, the combined Zhang et al. and Ohtani et al. disclose the method wherein the chemical oxide film is 5 nm or less (see Ohtani et al. column 2, lines 39-41).

In re claim 28, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31), specifically amorphous silicon, over an insulating substrate (1), forming a oxide film (33) on a surface of the semiconductor film comprising silicon, and doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118])-[0119]), forming a gate insulating film (5) over the semiconductor film after doping and forming a gate electrode (6) over the gate insulating film.

Zhang et al. does not disclose the method forming a chemical oxide film. The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film using a liquid chemical (see column 2, lines 44-46, and column 6, lines 55-64). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a

known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 31, Zhang et al. further discloses the method wherein in the doping step a material gas is at least one selected from the group consisting of diborane, phosphine, arsine and those obtained through dilution thereof with hydrogen (see [0118]-[0119]).

In re claim 34, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 39, the combined Zhang et al. and Ohtani et al. disclose the method wherein the chemical oxide film is 5 nm or less (see Ohtani et al. column 2, lines 39-41).

In re claim 29, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), forming an oxide film (33) which protects the semiconductor film from being etched by a subsequent doping step on a surface of the semiconductor film comprising silicon, doping the semiconductor film comprising silicon with impurity ions after forming the oxide film (see [0118]-[0119]),

forming a gate insulating film (5) over the semiconductor film after doping, and forming a gate electrode (6) over the gate insulating film.

The examiner notes that the protective oxide layer, 33, of Zhang et al. is formed directly prior to the doping process of Zhang et al. and therefore is formed to protect during the doping process. Further, Zhang et al. teaches that the acceleration voltage of the dopant is adjusted in accordance with the thickness of the protective oxide (see [0118]). The protective oxide layer of Zhang et al. will to some degree prevent etching of the surface of the semiconductor film when compared with a semiconductor film without the protective oxide formed thereon.

Zhang et al. does not disclose the method of terminating the dangling bonds on a surface of the semiconductor film with oxygen. Ohtani et al. discloses a method of forming a chemical oxide film by ultraviolet radiation within an oxygen ambient or immersing the substrate in ozone water or hydrogen peroxide water (see column 2, lines 39-46 and column 6, lines 55-64).

Ohtani et al. does not explicitly state that the pretreatment terminates dangling bonds on a surface of the semiconductor film with oxygen. However, as explained in the applicant's specification the termination of bonds in the present application occur with oxygen (see specification, page 17, line 13 through page 18, line 5). The examiner points out that the amorphous silicon of Ohtani et al. is oxidized by illuminating the substrate with a UV light in an oxygen ambient to form the chemical oxide. The examiner notes that UV light increases the reactivity of the oxygen atoms, and it is clear by the formation of the oxide that the oxygen molecules react on the surface of the

substrate, thus terminating the dangling bonds on the surface of the semiconductor film with oxygen. Finally the examiner notes that Ohtani et al. discloses the same conditions and steps as that of the applicant's disclosure with respect to forming the oxide. Applicant has not provided any required conditions for forming the oxide that would terminate the dangling bonds other than the presence of oxygen.

The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64) that terminates dangling bonds with oxygen as explained above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 32, Zhang et al. further discloses the method wherein in the doping step a material gas is at least one selected from the group consisting of diborane, phosphine, arsine and those obtained through dilution thereof with hydrogen (see [0118]-[0119]).

In re claim 35, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 30, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), forming an oxide film (33) which protects the semiconductor film from being etched by a subsequent doping step on a surface of the semiconductor film comprising silicon, doping the semiconductor film comprising silicon with impurity ions after forming the oxide film (see [0118]-[0119]), forming a gate insulating film (5) over the semiconductor film after doping, and forming a gate electrode (6) over the gate insulating film.

The examiner notes that the protective oxide layer, 33, of Zhang et al. is formed directly prior to the doping process of Zhang et al. and therefore is formed to protect during the doping process. Further, Zhang et al. teaches that the acceleration voltage of the dopant is adjusted in accordance with the thickness of the protective oxide (see

[0118]). The protective oxide layer of Zhang et al. will to some degree prevent etching of the surface of the semiconductor film when compared with a semiconductor film without the protective oxide formed thereon.

Zhang et al. does not disclose the method of terminating the dangling bonds on a surface of the semiconductor film with an element to be bonded with bonding energy higher than that of Si-H bonds. Ohtani et al. discloses a method of forming a chemical oxide film by ultraviolet radiation within an oxygen ambient or immersing the substrate in ozone water or hydrogen peroxide water (see column 2, lines 39-46 and column 6, lines 55-64).

Ohtani et al. does not explicitly state that the pretreatment terminates dangling bonds on a surface of the semiconductor film with an element to be bonded with bonding energy higher than that of Si-H bonds. However, as explained in the applicant's specification the termination of bonds in the present application occur with oxygen which is an element to be bonded with bonding energy higher than that of Si-H bonds (see specification, page 17, line 13 through page 18, line 5). The examiner points out that the amorphous silicon of Ohtani et al. is oxidized by illuminating the substrate with a UV light in an oxygen ambient to form the chemical oxide. The examiner notes that UV light increases the reactivity of the oxygen atoms, and it is clear by the formation of the oxide that the oxygen molecules react on the surface of the substrate, thus terminating the dangling bonds on the surface of the semiconductor film with oxygen. Finally the examiner notes that Ohtani et al. discloses the same conditions and steps as that of the applicant's disclosure with respect to forming the oxide.

Applicant has not provided any required conditions for forming the oxide that would terminate the dangling bonds other than the presence of oxygen.

The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64) that terminates dangling bonds with an element to be bonded with bonding energy higher than that of Si-H bonds as explained above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 33, Zhang et al. further discloses the method wherein in the doping step a material gas is at least one selected from the group consisting of diborane, phosphine, arsine and those obtained through dilution thereof with hydrogen (see [0118]-[0119]).

In re claim 36, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a

DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

Response to Arguments

Applicant's arguments filed February 16, 2005 have been fully considered but they are not persuasive.

The examiner notes that the newly added limitations have been addressed in the rejection above. Specifically, in the combined rejection of Zhang et al. and Ohtani et al., Ohtani et al. is relied upon for showing that the chemical oxide is formed by a liquid chemical and that the chemical oxide is formed to be 5 nm or less (see Ohtani et al. column 2, lines 39-45).

Applicant again argues that the examiners rationale for combining stating that "merely asserting that the method of forming an oxide layer lacks criticality in the invention of Zhang et al., or that Ohtani is a known method of forming and oxide that improves the surface characteristics of the underlying film is not sufficient to instruct one of ordinary skill in the art to use the Ohtani method to form the protective film 33 in Zhang." The examiner disagrees and notes that Ohtani et al. teaches an advantage of forming the oxide layer by this method which is to improve the surface characteristics of the underlying film. This teaching, and the resulting advantage, would instruct one of

ordinary skill in the art to form the oxide layer of Zhang et al. by the method of Ohtani et al. Further, as pointed out in a previous response, the improved surface characteristics allow for a nickel catalyst to be used In Ohtani et al., which accelerates the crystallization of the amorphous film. The combination of Zhang et al. and Ohtani et al. have also been relied upon to show the limitations of a metal catalyst for crystallization of the amorphous silicon.

The above reasons are why one would have been motivated to combine Zhang et al. and Ohtani et al.

The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See Ex pa/e Oô/aya, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Applicant state that examiner had not addressed some of Applicant's arguments in the previous reply.

The first argument allegedly not addressed by the examiner is that of why the advantage of the improved surface characteristics of Ohtani et al. would apply to the Zhang et al. reference. The examiner notes that the improved surface characteristics of the amorphous film prevents water from repelling. The advantage of the water no longer being repelled from the surface of the amorphous silicon allows for a nickel catalyst to be applied which allows for accelerated crystallization of the amorphous silicon. Thus, the chemical oxide also provides the additional benefit of accelerating

crystallization and thus increasing throughput. The examiner notes that this advantage was addressed in the Advisory action.

The second argument allegedly not addressed by the examiner is that of "Whether the Official Action is relying on Ohtani to teach a method of forming a thin oxide film in lieu of the protective film 33 in Zhang, or whether the Official Action is relying on Ohtani to teach that the method of forming the thin oxide film in Ohtani should be used to form the protective film 33 in Zhang, the Official Action still has not provided a reason why such combination should take place, which is legally required to form a prima facie case of obviousness." The examiner believes she has repeatedly addressed why it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the references. However, in an effort to avoid any confusion the reasoning will be provided again. The examiner maintains that it would have been obvious to form the oxide film of Zhang et al. by the method of Ohtani et al. since the examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer 33 in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., **since the method of forming an oxide layer lacks**

criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

The third argument allegedly not addressed by examiner is "Although the Official Action has shown that protective film 33 exists in Zhang, and, independently and separately: that there is a method of forming a thin oxide film (not shown) in Ohtani, the Official Action has not shown why it would have been obvious to use the method in Ohtani of forming the thin oxide film as (or in lieu of the method of forming the protective film 33 of Zhang." The examiner believes she has repeatedly addressed why it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the references. However, in an effort to avoid any confusion the reasoning will be provided again. The examiner maintains that it would have been obvious to form the oxide film of Zhang et al. by the method of Ohtani et al. since the examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer 33 in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., **since the method of forming an oxide layer lacks criticality in the**

invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Kennedy whose telephone number is (571) 272-1672. The examiner can normally be reached on Mon.-Fri. 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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jmk